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"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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THE ZOOLOGICAL RESULTS OF THE "CHALLENGER" EXPEDITION.

Report on the Scientific Results of the Voyage of H.M.S. "Challenger" during the Years 1873–76 *under the Command of Capt. G. S. Nares, R.N., F.R.S., and of the late Capt. F. T. Thomson, R.N.* Prepared under the Superintendence of the late Sir C. Wyville Thomson, Kt., F.R.S., &c., and now of John Murray, one of the Naturalists of the Expedition. Zoology—Vols. XX. and XXI. (Published by Order of Her Majesty's Government, 1887.)

THE twentieth volume of the "Zoological Reports of the Voyage of H.M.S. *Challenger*" contains three memoirs, of which the first is "On the Monaxonida," by Stuart O. Ridley, M.A., and Arthur Dendy, B.Sc. The collection of this group of the Sponges was, in the first instance, intrusted to Mr. Ridley, who, to hasten the completion of the work, was afterwards joined by Mr. Dendy.

When about ten years ago Prof. Zittel gave the name Monactinellidæ to an order of Sponges, the position of this group became for the first time clearly defined. Prof. Sollas, some five years later, pointed out that Zittel's name implied a wrong idea, for that the characteristic spicules of the group were just as often "diactinal" as "monactinal," and suggested that, as both these forms were, however, "monaxonid,"—that is, having only one axis, which, in the case of the diactinal forms, passed through both the rays—the group should be called Monaxonidæ. As this group represents a division higher than that of a family, for which the termination "idæ" stands, all subsequent writers have adopted the name "Monaxonida." This group Sollas now regards as a tribe of the sub-class Demospongiæ, but the authors of this Report consider it with Zittel as one of the orders of the class.

The classifications of Gray, Bowerbank, Schmidt, or Carter, have now little but historic interest, while as for the more recent writers it would even seem as if each new series of novelties described necessitated a fresh shuffling of the orders, sub-orders, and families.

In the chapter on the anatomy and histology of the group the subject of the spicules is fully treated. It appears to us that no apology was needed for passing over the writings of Bowerbank on these forms; and when the authors too modestly refer us for further details as to the nature, &c., of siliceous spicules to, among other volumes, those of this author, we prefer, without meaning the slightest reflection on his great labours, to turn instead to the pages of the present Report.

The very difficult subject of a nomenclature for the spicules is treated at some length. Those of this order are divided into the two classes of "mega-" and "micro-" "sclera." In each of these there is a very numerous series of forms, all of which get separate names, founded on some prominent distinguishing character of the spicule. Let us hope that the majority of these names may find acceptance with writers on this group of Sponges, so that one difficulty in its study may be removed.

Passing over the descriptions of the spongin, the arrangement of the skeleton, and those of the ectosome and choanosome, we must briefly notice a very remarkable structure, which would appear to be quite unique, and which is found in a Sponge (*Cladorhiza tridentata*, sp. n.) from a depth of 1600 fathoms. The little Sponge in which this occurs is in shape somewhat like a miniature watch-stand. Embedded in the soft tissues, all around the upper margin of the concavity, a large number of small yellow globular bodies are found. Each globular body consists of a central, more deeply staining and granular portion, surrounded by and embedded in a matrix of faintly staining, perfectly hyaline ground substance. The granular appearance of the central mass is owing to very numerous embedded cells; these are irregular in shape and nucleated. Other peculiar cup-shaped bodies occur towards the periphery of the Sponge, embedded in the matrix. The authors think it probable that the cup-shaped bodies are aggregations of glandular cells similar to those met with in the ectosome of some other Sponges, and hint that the whole structure may be phosphorescent, and serve to attract minute organisms upon which the Sponge feeds. In regard to the canalsystem the authors' general conclusions are quite in accord with those of Vosmaer and Polejaeff. In the classification adopted the order is divided into two sub-orders, Halichondrina and Clavulina. The first of these is divided into four families: I. Homorrhaphidæ, II. Heterorrhaphidæ, III. Desmacidonidæ, and IV. Axinellidæ; the second into I. Suberitidæ, and II. Spirastrellidæ.

Over 200 species or well-marked varieties are described from the *Challenger's* dredgings, but all the new species were first diagnosed in the *Annals and Magazine of Natural History* during the course of last year (1886).

In reference to the geographical distribution, the authors remark that one cannot fail to notice the small number of stations at which these Sponges were found. Out of a total of 277 distinct stations, only 50 are represented as stations for these Monaxonids, and these are supplemented by 20 localities to which no station-number is attached; and these latter were not, it is to be assumed, deep-sea stations. We cannot agree with the suggestion that these forms were overlooked amongst the "rubbish" in sorting out the contents of the trawls and dredges; or with the idea that owing to their fragility they may have been destroyed. Doubtless the true explanation is that "the Monaxonida are not, on the whole, a predominant group in deep water."

While not a predominant group in deep water, still no less than 24 species were found at depths between 1000 and 2000 fathoms, while 46 occurred between depths of 200-1000 fathoms, and 140 species, or exactly double the previous number, were found at depths of from 0-200 fathoms.

The scarcity of Monaxonid Sponges at very great depths is somewhat compensated for by the unusual interest attaching to the species which do occur. Among other facts we find that, while the shallow-water forms are characteristically more or less shapeless in their external form or at the very most digitate or ramose, those from below the 1000-fathom depth have almost without exception beautifully symmetrical and definite shapes.

One of the most beautiful and extraordinary of the species described and figured is *Esperiopsis challengeri*, Ridley: it was taken in some quantity off the east of Celebes Island from a depth of 825 fathoms. From a slightly expanded attached base a slightly curved stem arises, which is composed of densely packed and firmly united stylote spicules: this stem is compressed laterally; numerous short simple branches arise from the concave edge at gradually increasing intervals, the longest of the internodes being at the top; the main stem and each of these branches terminate in fleshy sponge lamellæ, of which there may be six or seven in an apparently full-grown specimen. Each lamella presents the form of a deeply concave, transversely elongated cup: the oscula are confined to the convex surfaces of the lamellæ; the pores are found on the concave surfaces. This species is figured on Plate XVIII. Fifty-one plates accompany this Report.

The second Report in this volume is a supplement to Dr. L. von Graff's Report on the Myzostomida. It includes the description of seven new forms besides fourteen previously described species, all received from Dr. P. Herbert Carpenter; these were found by him while investigating the *Challenger* Crinoids. The author refers to the so called cysts of *Antedon rosacea*, but declares that in no one case did he find therein any trace of a Myzostoma or any other encysted organism. On the contrary, both in the various pinnule deformities and in the arm swellings, he found a roundish brown foreign body, which was apparently the cause of the deformity. As to the nature or origin of this body nothing has been determined. Three plates of the new species and one of the cysts of *Antedon rosacea* accompany this Report.

The third Report is on *Cephalodiscus dodecalophus*, McInt., by Prof. W. C. McIntosh. This very remarkable new type of Polyzoon was dredged in the Strait of Magellan, and was, when first found, placed among the Compound Ascidians. The late Mr. Busk, Prof. Allman, and Prof. McIntosh, referred it to the Polyzoa. At first sight the flexible cœnœcium might easily be taken for a sea-weed, but it would seem to spread over the surface of the ground and not to grow erect. Of the numerous branches many anastomose; the general surface is spiny or fimbriated; the interior of the stem and branches contains an irregular series of wide canals. The Polypides are described as being perfectly free and at liberty to wander anywhere along the chambers, or even externally through the apertures. Each adult Polypide measures, from the extremity of the cephalic plumes to the tips of the pedicel, about 2 millimetres. Large buds in various stages of development arise from the Polypides. The twelve branchial plumes are very conspicuous. The author thinks that Cephalodiscus approaches Rhabdopleura. In an important appendix, by Mr. Sidney F. Harmer, the affinities of this form to Balanoglossus are ably pointed out, and he thinks that this genus (and perhaps Rhabdopleura also), must be removed from the Polyzoa and placed in Bateson's group of the Hemichordata. Seven plates and numerous woodcuts illustrate this Report.

Volume XXI. contains but one Report, that on the Hexactinellida, by Prof. F. E. Schulze, of the University of Berlin. This volume is issued in two parts, the first that of the text, comprising over 500 pages, and the second consisting of an atlas of 104 plates.

This is one of the most important of the fifty-three Reports hitherto published. This group of Sponges early attracted the special attention of the late Sir Wyville Thomson; and it was his intention to describe the Hexactinellids of the *Challenger* Expedition, but the work had scarcely been seriously commenced at the time of his death. It was fortunate that the services of Prof. Schulze were secured for the writing of this monograph, which is a most acceptable and welcome addition to our literature of this group.

In this Report, besides the collection made by the *Challenger*, the results of the previous cruises of the *Lightning*, *Porcupine*, *Knight Errant*, and *Triton* are also detailed, and the material has been further increased by a collection made at Japan by Dr. Döderlein.

The Hexactinellids are those forms of the Sponges in which the siliceous spicules belong to the triaxial type. Omitting the eighteenth century reference to a Sponge belonging to the genus Dactylocalyx, Dr. Gray was the first in the present century to describe some peculiar "glass rope-like" structures in the British Museum under the name of Hyalonema; though without recognizing until long afterwards their real affinities. This was in

1832, and in the following year Quoy and Gaimard figured and described their *Alcyonellum speciosum*. During the next twenty years only five more species were added to the list, the beautiful *Euplectella aspergillum*, Owen, being the most remarkable of these. The last twenty-five years have, however, witnessed an ever-advancing progress in our knowledge of these Sponges, thanks to the labours of Gray, Bowerbank, Wyville Thomson, Schmidt, Kent, Carter, Marshall, Sollas, and, above all, of Zittel, which labours have now culminated in the present Report.

It is scarcely to be wondered at that the beautiful glassy frame-work and the charmingly diversified spicules which form their "skeletons" have always attracted attention to these Sponges—an attraction that will be greatly intensified by the publication of this volume.

The Report opens with a general historical introduction, and then passes on to details of the forms and structures to be met with in the group: herein we find the nomenclature adopted for the spicules. This is followed by the description of the genera and species. It is pleasant to find in the synonymy and specific details that great pains have been taken to mention the work of all previous labourers in the field, and the author shows a due and kindly appreciation of what has been done by those who often had but little light to guide them on their way.

It is not easy to give any analysis of so elaborate a memoir, in which twenty new genera and sixty-five new species are described; while with scarcely an exception the numerous species already described are not only alluded to, but many fresh details are given about them. When it is recollected that but fourteen years ago only thirty species of this group of Sponges were known, the progress of our knowledge of them, it will be recognized, has been great.

These Sponges seem to be widely distributed in all the oceans; the largest number of forms—fifty-seven—being found in the Pacific Ocean; next comes the Atlantic Ocean, in which twenty-four species were found; while only sixteen were found in the South Indian Ocean; but it must not be forgotten that the South Indian Ocean has been very slightly investigated.

As to the bathymetrical distribution of the Hexactinellida, they would appear to be met with in depths of between 95 and 3000 fathoms, being more numerous between the depths of 100 and 900 fathoms, decreasing somewhat between those of 900 and 2500 fathoms, and again markedly diminishing between the depths of 2500 and 3000 fathoms, while below this depth no Hexactinellida Sponges have been found. Euplectellids seem to have a wide range, being met with at the moderate depth of 95 fathoms, and then being pretty evenly distributed down to a depth of 2750 fathoms. The four species of the new genus Holascus frequent great depths, varying from 1375 to 2650 fathoms. The maximum depth as yet known for any of these Sponges is that of 2900 fathoms, at which depth *Bathydorus fimbriatus* was found in the middle of the North Pacific Ocean.

It would be obviously impossible to give even a brief summary of the very remarkable new forms described in this splendid memoir of Prof. Schulze, and it is difficult to convey a correct notion of the beauty of the illustrations forming the large atlas of plates which accompanies the text. The diagnoses of the genera and the descriptions of the species are what one would expect from the well-known skill of the author.

We do not altogether agree with him when he writes that, "after a detailed investigation of a group of animals, it is incumbent on every naturalist who accepts the evolution theory to attempt the appreciation of his results in their relation to the phylogeny of the group." Looking at his array of facts, is it not possible for the thoughtful worker to bear in mind the incompleteness of the phylogenic record, and reverently to wait for more light? There may be nothing to object to in the stately genealogical tree of the Hexactinellida represented on p. 495, but is it not built up on but an incomplete and scanty framework?

One departure in this Report from the ordinary custom in the description of species we notice with regret—viz. that there is no synonymic list affixed to the species, neither are we referred, in connection with each form, to the place or places where it has been previously described. It seems scarcely necessary to point out the inconveniences attending such a style, or the great uncertainty it may on occasions give rise to. The volume opens at the description of *Rosella antarctica*, Carter. To find where it was first described by Mr. Carter we are obliged to refer to the synonymy affixed to the diagnosis of the genus; but here we get no certain information as to how many of the quotations given refer to this species; and this is of course much more confusing when we come to investigate a genus abounding with species, like, for example, Hyalonema. Indeed, by this method an author is very apt to overlook the fact that several writers may refer to the same species under quite different names, and a curious case of this nature, we suspect, occurs under Hyalonema. Dr. Gray, wrongly trusting to a Museum label, replaced the name *Hyalonema sieboldii*, which he had given to the first known species of this genus in 1835, by that of *H. mirabile*, under the impression that he had so named it in the "Synopsis of the Contents of the British Museum," 1832 (misprinted 1830), the year he had got the analysis of its glassy fibres from Mr. Pearsall. Depending on the accuracy of Dr. Gray, many authors referred to the species under this latter name; and further, for some time after the discovery of the Setubal species by Prof. Barboza du Bocage, this species, now known as *H. lusitanicum*, passed as the same species as *H. mirabile* = *H. sieboldii*. Even from the details given by Prof. Schulze, this seems clear; but in the description of Bocage's species (p. 225) no synonymic list is given, and not only does the before-mentioned fact not appear, but we find *H. lusitanicum* placed among those species "the upper end of which was not sufficiently preserved for deciding the question whether there is a sieve-plate or not." It is added that "neither on this specimen (the one figured in the Proc. Zool. Soc. Lond.) nor on others which Bocage afterwards obtained from the same locality could any portion of the sponge body be detected." But on p. 186 we find it stated that *H. lusitanicum* had been dredged from a depth of 480 fathoms south-west of Setubal, "bearing a sponge body with several oscular openings"; and again on the same page that among the Hyalonema found off the coast of Portugal by Barboza du Bocage and others, and named *H. mirabile*, there was one specimen with an oval cup-shaped body about 8 inches in length and 4 inches in breadth, with a sieve-net on the upper truncated surface of the sponge body, extending evenly over the oscular opening and over the layer of the "spiculate cruciform spicules" in the net beams. We may further add that there were to be found in the Museum at Lisbon nearly a dozen specimens of Hyalonema which were taken at Setubal. "Most of them were preserved in spirits of wine; they were certainly the very finest collection of this remarkable Sponge in Europe. The largest had a stem about 18 inches in height; there were no parasites of any kind on it, and it was furnished with a sponge mass some 8 inches in diameter, and nearly as much in height. A second specimen was very curious, for here two apparently distinct individuals had become matted together: the two glass ropes were interlaced, and the two sponge masses had grown together" (Proc. Dublin Nat. Hist. Soc., vol. v., 1869). It would have been most important to have had the opinion of such an authority as Prof. Schulze as to whether all these specimens from Setubal are referable to Bocage's species; and whether, as we venture to think, Marshall's *H. thomsoni* may not be only a well-marked variety thereof. It is possible that by thus calling attention to the subject we may yet learn more of the treasures of the Museum of Lisbon, and nothing in these remarks can in the very slightest degree detract from the merits and importance of this splendid contribution to our knowledge of the vitreous Sponges. E. P. W.

THE FERN-ALLIES.

Hand-book of the Fern-Allies: A Synopsis of the Genera and Species of the Natural Orders Equisetaceæ, Lycopodiaceæ, Selaginellaceæ, Rhizocarpeæ. By J. G. Baker, F.R.S., F.L.S., First-Assistant in the Herbarium of the Royal Gardens, Kew. (London: George Bell and Sons, York Street, Covent Garden, 1887.)

AS the author states in the preface, "The present Hand-book is planned upon the same lines as Hooker and Baker's 'Synopsis Filicum,' and the two, taken in connection, cover the whole series of the Vascular Cryptogamia." The total number of species described in the "Hand-book" is 566, and as we may now place the number of known ferns at about 3000, the fern-allies may be taken to represent about one-seventh of the recent Vascular Cryptogams. The fern-allies include only eleven genera, and about four-fifths of the species belong to the two genera *Selaginella* (335 species) and *Lycopodium* (94 species). The eleven genera are placed by Mr. Baker in four "natural orders," while the Filices form a fifth: three of these, Filices, Equisetaceæ, and Lycopodiaceæ, being isosporous; and two, Selaginellaceæ and Rhizocarpeæ, being heterosporous. In this way the relationship of the Rhizocarpeæ to the ferns is quite lost sight of; the Selaginellas and Lycopods are separated more widely than is desirable, and no place is left for the fossil heterosporous Equisetinæ. The arrangement adopted by Mr. Baker is very good for herbarium work; but for classificatory purposes it ignores certain palæontological facts which we cannot at the present day afford to overlook. Mr. Baker, however, does not deal with the fossil types, and now that we have such a complete account of the recent forms, let us hope that before long we may have as complete a synopsis of the fossil forms; a work which would be of the greatest interest and importance.

In regard to the geographical distribution of the fern-allies it is interesting to notice that *Equisetum*, *Isoëtes*, and *Pilularia* predominate in the North Temperate Zone. *Lycopodium*, *Psilotum*, *Selaginella*, *Salvinia*, and *Marsilea* are eminently tropical; and *Phylloglossum* is peculiar to the South Temperate Zone. Like the ferns, the fern-allies are best developed in the Tropics; and in the Tropics we also find the greatest number of peculiar species. Thus, out of the 566 species, 484 are met with in the Tropics of the Old and New World; and no less than 402, or 83 per cent., of these are peculiar to the Tropics. As with the ferns so also with the fern-allies, tropical America is richest in species, including 237 species, of which 212 are peculiar. The Southern Temperate Zone yields only 83 species, of which 42, or 51 per cent., are peculiar, the fern-allies being thus much less numerous than the ferns in the southern flora. In the North Temperate Zone 150 species are met with, and of these 48, or 32 per cent., are peculiar. The North Temperate Zone is thus, like the South, deficient in fern-allies as compared with ferns, and this is apparently due to the small number of fern-allies as yet reported from temperate Asia. Only 6 species occur in the Frigid Zone, and, like the ferns, represent about 1 per cent. of the whole, none of the species being peculiar.

It is difficult to realize the amount of labour and research that must have been spent upon the production of this book; but anyone who has attempted to study the genus *Selaginella* will appreciate the masterly manner in which Mr. Baker has dealt with the 335 species of the genus, more than one-fourth of which he has himself described for the first time. Most of the species of Selaginellaceæ and Rhizocarpeæ have been described by Mr. Baker in his papers on the subject which have appeared from time to time, since 1883, in the *Journal of Botany*, but several new species are described in "Fern-Allies" for the first time, recent additions to the rich treasures of Kew. It is to be regretted that Mr. Baker does not more particularly refer to his papers in the *Journal of Botany*, and it is hard to understand why, in the descriptions of *Marsilea concinna* and *M. condensata*, he has omitted the references to the *Journal of Botany*, 1886, pp. 179 and 281 respectively. Then in transferring the matter from the *Journal of Botany* he has altogether dropped out the habitat of *Azolla nilotica*. There are also in the book not a few misprints, and a want of care is shown in numbering and lettering the sections of *Selaginella*. The index is also not quite up to the mark, as in *Marsilea*, with numerous synonyms omitted, and the misprints in *Pilularia* and *Psilotum*. As the index of the "Synopsis Filicum" was published separately as a catalogue of ferns, we may perhaps be permitted to express a hope that this index will not be so published until it is carefully revised. All that is wanting, however, is only a little more careful editing, and the few faults in no way detract from the sterling value of the work.

As the only modern synopsis of the group, it is a work that must be in the hands of every botanist who deals with the Vascular Cryptogams, and it will be a lasting monument to Mr. Baker's critical accuracy and great power of dealing with a difficult set of plants. W. R. McNab.